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BEFORE THE STATE OF WASHINGTON
ENERGY FACILITY SITE EVALUATION COUNCIL

IN RE APPLICATION NO. 99-1

EXHIBIT _____ (EH-RT)

SUMAS ENERGY 2 GENERATION
FACILITY

APPLICANT'S PREFILED REBUTTAL TESTIMONY

WITNESS: ERIC HANSEN

Q. Please reintroduce yourself to the Council.

A. My name is Eric Hansen. I am an air and noise consultant at MFG, Inc., and I had lead responsibility for the analysis of air and sound emissions associated with the Sumas 2 Generation Facility (S2GF).

Q. What topics will you address in your rebuttal testimony?

A. My rebuttal testimony will focus on issues concerning air emissions, greenhouse gas emissions and sound emissions. In particular, I have been asked to respond to portions of the testimony of Richard Gammon (CFE), Bradley Smith (CFE), Philip Mote (NVEC), Peter West (NVEC), Axel Franzmann (Whatcom), Karen Grenzow (Whatcom); Carl Jager (Whatcom), Jane Koenig (Whatcom), David Lipscomb

EXHIBIT ____ (EH-RT)

ERIC HANSEN'S

PREFILED REBUTTAL TESTIMONY - 1

[31742-0001/Eric Hansen Rebuttal.doc]

PERKINS COIE LLP
1201 Third Avenue, Suite 4800
Seattle, Washington 98101-3099
(206) 583-8888

(Whatcom), Ioana Park (Whatcom), Peter Sim (Whatcom), Dan Jaffe (Whatcom),
Connie Hoag (Abbotsford/Hoag), Jerry Lilly (Abbotsford) Peter Sagert (Abbotsford),
Don Gustafson (Hoag), Nathan Kronenberg (Hoag), and John McKay (Hoag).

Air Quality

Q. Several witnesses mentioned air quality issues that they contend were not addressed in SE2's Application for Site Certification. Can you explain the scope of your air emissions analysis?

A. MFG prepared the Application for Site Certification (the Application) in accordance with EFSEC's regulatory requirements. That air quality review focused on Best Available Control Technology (BACT), compliance with ambient air quality standards, a Prevention of Significant Deterioration (PSD) increment assessment, and the analysis of air quality related values in federal Class I areas. We believe we prepared a very thorough application, and trust that EFSEC's air quality technical reviewer will concur.

Virtually all the comments by intervenor witnesses concerned the impact of S2GF emissions on Canadian air quality. We tried to address Canadian concerns in the Application by comparing predicted (cumulative) concentrations with Canadian air quality standards and objectives. In addition to the EFSEC process, we have had an ongoing dialog with the Ministry of Environment Land and Parks (MELP) and other Canadian bodies. That dialog began on April 16, 1999, with a presentation to, and discussion with, the Lower Fraser Valley Air Quality Coordinating Committee, a group of air quality professionals representing Environment Canada, MELP, the

1 Greater Vancouver Regional District (GVRD), and the Fraser Valley Regional
2 District. After that meeting, we were informed that MELP would represent the
3 multiple Canadian regulatory bodies with jurisdiction over air quality issues. Bruce
4 Thompson, Vice President of SE2, and I also made presentations to the Fraser Valley
5 Regional District board later that year and again this year.
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12 In response to our request, MELP provided SE2 with a list of Canadian issues and
13 concerns in a letter dated December 14, 1999. I prepared a response for SE2 dated
14 January 7, 2000 that addressed the concerns raised. MELP sent a follow-up letter on
15 February 23, 2000 that requested additional information on some issues, and raised
16 several new issues. We at MFG then prepared a very detailed, 52-page response to
17 this series of questions that was included in an April 18 letter from SE2 to MELP
18 (Exhibit ____ (EH-5)). Because some of the issues are very complex, we also provided
19 large quantities of digital data from our computer models to enable MELP and other
20 interested Canadian bodies to conduct their own evaluation and interpretation of the
21 results.
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34 We have since met with MELP technical staff twice in Vancouver and once in White
35 Rock to discuss the results of our evaluations of Canadian issues and to discuss the
36 results of Environment Canada's photochemical (ozone) modeling analysis of the
37 project. We also corresponded by email and telephone numerous times over the last
38 year to maintain a very direct and open discussion. It is my understanding that MELP
39 staff have found us to be responsive to their requests and have been impressed with
40 our technical work. Even Peter Sagert's testimony on behalf of the City of
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1 Abbotsford and the Abbotsford Chamber of Commerce acknowledges “the proponent
2 has reasonably attempted to inform the interagency environmental committee and their
3 subsidiary Canadian agencies of steps being taken by SE2 to evaluate air quality on the
4 Canadian side of the Lower Fraser Valley (LFV).”
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10 In addition to the technical information we have provided to MELP, on May 24, 2000,
11 SE2 sent a letter to MELP, which I attach as Exhibit __ (EH-6), that identifies a series
12 of commitments that further reduce the project’s air quality impacts in Canada. These
13 commitments include a reduction in the proposed NOx emission rate to 2 ppm; the
14 funding of the installation of an air quality monitoring station on Sumas Mountain; a
15 reduction in the number of oil-firing days from 15 days per year to 10 days per year,
16 averaged over a ten-year period; the possibility of curtailing S2GF operations during
17 adverse air quality episodes subject to certain specified conditions; and the willingness
18 to explore means of off-setting S2GF air emissions by cleaning up existing air
19 pollution sources in the Lower Fraser Valley. In my experience, these offers are
20 unprecedented, especially when one realizes that they are occurring outside of the
21 normal regulatory processes.
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36 Because this dialog has occurred outside the traditional EFSEC (and PSD) review
37 process, there is no reason that intervenors would have been included in this dialog
38 and technical interchange. No one was intentionally excluded, but it was our
39 understanding that MELP was our point of contact and that other jurisdictions were
40 relying on MELP’s technical review. Most of the comments raised by intervenors
41 have been exhaustively addressed in our discussions with MELP. The intervenors may
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1 not have been aware of those analyses because they focused on the Application and
2 the Draft EIS, and had not requested any additional information regarding these issues.
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6 **Q. Mr. Sagert compared the U.S. permit review process as a “cookbook” approach**
7 **and acclaimed Canada’s need for “flexibility.” What is your perspective?**
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10 **A.** I don’t think it is entirely fair to refer to the U.S. approach as cookbook. EPA has
11 published a manual that identifies the general procedures for preparing a PSD permit
12 application, but there are always issues that are not addressed by the manual. Over the
13 course of a permit process, the permit reviewer has ample discretion to request that
14 certain project-specific issues be addressed. Bernard Brady, the EFSEC permit
15 reviewer for S2GF, has requested information on numerous topics that would
16 probably fall outside of any cookbook approach. What we do have in the United
17 States is a process that entitles applicants to a PSD permit if they demonstrate that the
18 project meets emission limits, applies BACT, complies with ambient air quality
19 standards and PSD increments, and does not have a significant adverse effect on Class
20 I area.
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35 Still, we recognized early in this process that Canadian questions were legitimate –
36 even if they fell outside the PSD “cookbook” and EFSEC’s Application guidelines. As
37 demonstrated by the information we have submitted to MELP, we have tried to fully
38 respond to Canadian requests for additional analysis and information.
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1 **Q. In Ms. Hoag's testimony, she expresses concern that "nearly 3 tons per day" of**
2 **"criteria and toxic pollutants" will be emitted from the proposed power plant.**
3 **Are her concerns well founded?**
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7 A. Air emission rates are presented in Tables 6.1-2, 6.1-4, and 6.1-5 of the Application.
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9 When firing gas, the plant would emit approximately 0.8 tons of criteria pollutants and
10 0.4 tons of toxic air pollutants per day. When firing oil, the plant would emit
11 approximately 3.2 tons of criteria pollutants and 0.5 tons of toxic air pollutants per
12 day. Over the course of the year, the plant would emit an average of 1.9 tons per day
13 of criteria pollutants and 0.8 tons per day of toxic air pollutants. Ammonia slip from
14 Selective Catalytic Reduction (SCR, the equipment employed to reduce oxides of
15 nitrogen) accounts for 93 percent of the toxic air pollutants on an annual basis. While
16 it is considered a toxic air pollutant in Washington, it is not considered a hazardous air
17 pollutant by federal law.
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28 I believe the more relevant consideration is the environmental and health implications
29 of those emissions. Because S2GF is a significant source of air emissions, its
30 permitting process appropriately required a very extensive air quality analysis. That
31 analysis demonstrated that the predicted concentrations are far below the standards
32 established in the United States to protect human health and welfare (Application
33 Tables 6.1-13, 6.1-14, 6.1-20). Furthermore, the incremental contribution to air
34 pollution in both Class I and Class II areas was far below the increments established by
35 EPA's PSD permitting process to prevent significant deterioration of air quality
36 (Tables 6.1-17, 6.1-18). We believe the testimony of Axel Franzmann, Air Quality
37 Control Specialist with the Northwest Air Pollution Authority, for Whatcom County is
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1 correct when he states that “it appears that the impact of Sumas 2 Generating Facility
2 on existing air quality will be rather minimal.”
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6 As I noted above, SE2 is currently exploring several opportunities to offset S2GF
7 emissions with emission reductions at existing Canadian sources. Chuck Martin
8 describes SE2’s efforts in this regard in his rebuttal testimony.
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14 **Q. Both Mr. Sagert and Ms. Hoag criticized the ambient particulate data used in**
15 **the modeling. Is their criticism fair?**
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18 A. I don’t understand this criticism. To estimate background particulate matter
19 concentrations, we identified the highest 24-hour concentrations and the annual
20 concentrations measured in Abbotsford for the period 1996 through 1998, inclusive.
21 We took the average of the highest 24-hour measurements from each of the three
22 years and used that as the “background” 24-hour concentration. Clearly, this is a
23 conservative assumption, given that virtually all days of the year have lower
24 concentrations than the maximum day. We took the average of the three annual
25 averages and used that as the “background” annual concentration.
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36 In a public meeting, Ms. Hoag has also accused MFG of using Abbotsford monitoring
37 data because it was lower than elsewhere. In fact, we used Abbotsford data because
38 that monitoring station is closest to the S2GF site. We subsequently investigated
39 monitoring data from Hope and Chilliwack locations for the same period, but found
40 those concentrations to be the same or lower than those measured at Abbotsford.
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1 **Q. In her testimony, Dr. Koenig and Dr. Jaffe raised concerns about the potential**
2 **health effects of particulate matter emissions from the facility. Are their**
3 **concerns justified?**
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7 A. The Application focused on PM10 because that is the form of particulate matter that is
8 currently regulated in the United States. The U.S. has both ambient air quality
9 standards, which were developed to be protective of human health, and PSD
10 increments for PM10. Our analysis indicates S2GF emissions would generate ambient
11 concentrations far below both of those regulatory limits.
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18 Just as the U.S. periodically revisits the National Ambient Air Quality Standards
19 (NAAQS), Canada is now revisiting its air quality objectives and guidelines. GVRD
20 has adopted an interim objective PM10 level of 50 ug/m3, which is only one third the
21 U.S. standard of 150 ug/m3. As we noted in our Application, Fraser Valley air quality
22 monitoring stations already occasionally measure concentrations that exceed that
23 interim objective, which led to Drs. Koenig and Jaffe to express concern about the
24 incremental impact of emissions from S2GF. However, closer examination indicates
25 that the meteorological conditions that produce maximum concentrations in the Fraser
26 Valley now are not the same meteorological conditions that are would produce the
27 maximum concentrations from S2GF. In other words, the S2GF emissions would not
28 make ambient concentrations significantly worse at those times in which Fraser Valley
29 concentrations are already close to or in excess of the interim GVRD PM10 objective.
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44 In his testimony, Dr. Jaffe questions this conclusion, suggesting that there is
45 insufficient evidence for the statement in the air quality section of the Application that
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1 a local source of particulate matter and strong outflow winds from the eastern Fraser
2 Valley are generally responsible for exceedances of the 24-hour PM10 objective.
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4 However, that text in our Application essentially paraphrases GVRD's 1996 Ambient
5 Air Quality Annual Report. Discussions with MELP suggest that evaluation of time
6 series of PM10 concentrations show peaks with strong easterly winds and again with
7 westerly winds that carry pollutants from the Vancouver metropolitan area. In
8 response to Dr. Jaffe's comment, we followed up with a telephone call to GVRD staff,
9 which confirmed that this situation has not changed. Maximum impacts in Canada
10 attributable to S2GF generally occur as a result of stable, low wind speed conditions.
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21 In response to a specific request in MELP's February 23 letter, MFG applied the
22 ISCST3 dispersion model to predict 24-hour PM10 concentrations at the Abbotsford
23 monitoring site. MFG conservatively assumed oil-fired emissions for each winter day
24 and gas-fired turbines with duct burners operating for all other days. Based on 5 years
25 of Abbotsford meteorological data, the maximum, 98th, 75th, and 50th 24-hour PM10
26 concentrations at the Abbotsford monitoring site attributable to S2GF were 1.4 µg/m³,
27 0.64 µg/m³, 0.033 µg/m³, 0.0 µg/m³, respectively.
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37 MFG also conducted additional CALPUFF simulations of the S2GF facility in order to
38 respond to the Ministry's request for further information concerning PM10, secondary
39 aerosols, and visibility impacts in the Lower Fraser Valley. Total PM10 concentrations
40 were calculated by summing direct PM10, sulfate, and nitrate concentrations after
41 correcting for the assumed molecular weight of the resultant secondary aerosols. It
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1 was assumed that sulfate and nitrate would be in the form of ammonium sulfate and
2 ammonium nitrate, respectively.
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6 For the purposes of comparison with the GVRD Interim Air Quality Objective of 50
7 $\mu\text{g}/\text{m}^3$, MFG added the measured Abbotsford PM10 concentration on the same days
8 as the prediction. On the day when S2GF has its maximum impact of 8 $\mu\text{g}/\text{m}^3$
9 (occurring with oil firing in winter), the Abbotsford background concentration was 25.
10 The total concentration of 33 $\mu\text{g}/\text{m}^3$ is well below GVRD's PM10 objective and only
11 22% of the U.S. standard. Adding other seasonal maxima to simultaneous Abbotsford
12 background concentrations, the total cumulative PM10 concentrations never exceeded
13 33 $\mu\text{g}/\text{m}^3$.
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24 **Q. Dr. Koenig also raised concerns about PM2.5 concentrations. What is your**
25 **response to her testimony?**
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28 A. Dr. Koenig addressed ambient air quality standards for fine particulate matter. She
29 noted that the United States EPA proposed a 24-hour average concentration of PM2.5
30 of 65 $\mu\text{g}/\text{m}^3$ and an annual standard of 15 $\mu\text{g}/\text{m}^3$. She also noted that an ad hoc
31 committee she served on several years ago recommended a more protective PM2.5
32 standard of 25 $\mu\text{g}/\text{m}^3$ on a 24-hour basis. However, this committee has no official
33 standing and we are not aware of the level of rigor applied to preparing that
34 recommendation.
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44 EPA has indeed proposed PM2.5 standards of 65 $\mu\text{g}/\text{m}^3$ on a 24-hour basis and 15
45 $\mu\text{g}/\text{m}^3$ on an annual basis. There are statistical considerations and some geographic
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1 averaging procedures that accompanied EPA's proposal that made compliance with
2 these standards a little more complicated than the existing "2nd highest" 24-hour
3 concentrations and standard annual average PM10 standards. However, given that the
4 PM2.5 emissions from S2GF are less than or equal to the PM10 emission rates we
5 evaluated, the project impact on PM2.5 concentrations would be less than or equal to
6 the project PM10 concentrations we predicted. Furthermore, background PM2.5
7 concentrations are, by definition, lower than or equal to background PM10
8 concentrations. Consequently, we know the total PM2.5 concentrations would be less
9 than the predicted PM10 concentrations, which (at 33 ug/m3) are less than 65 ug/m3.
10 Therefore, we anticipate compliance (by a wide margin) with a PM2.5 standard of 65
11 ug/m3.
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25 **Q. Dr. Jaffe suggested that NOx from S2GF has the potential to make the ozone**
26 **problem worse. Is that criticism fair?**
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28 **A.** It is fair to say that any increase in air emissions has the potential to make air pollution
29 worse – the question is whether the effect is significant or not. We noted in our
30 application that S2GF NOx emissions (at 236 tons per year) would be a very small
31 fraction of the regional NOx emissions. This is a fair comparison because ozone,
32 which is created in the atmosphere in the presence of NOx, VOCs, and sunlight, is a
33 regional air pollution problem – as opposed to localized impacts such as those with
34 high CO concentrations. On a qualitative level, then, it is clear that S2GF's NOx
35 emissions would have a very slight effect on regional ozone episodes. The recently
36 proposed 33 percent reduction in NOx emissions will make that effect even smaller.
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1 We also provided MELP with the emission characteristics of S2GF to enable
2 Environment Canada to conduct its own photochemical (ozone) modeling.
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4 Environment Canada's report, which was provided with my direct testimony as Exhibit
5 ____ (EH-3) indicates the project would have a "localized" and "small increase in
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7 ozone episode intensity and no increase in ozone episode duration" for the ozone
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9 episode meteorological conditions examined.
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15 **Q. Dr. Jaffe testifies that he believes "it is appropriate to require the most stringent**
16 **NOx standard which technically feasible" to control NOx. What is your**
17 **response?**
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20 A. SE2 concurs, and has agreed to upgrade the SCR identified in the Application to
21 better control NOx, consistent with the continuing evolution of NOx control
22 technology. Peter Sagert acknowledges: "Assuming that the 2 ppm limit becomes
23 enforceable as a permit limit (1-hour average), it represents the lowest achievable
24 emission rate (LAER)." Indeed, 2 ppm has been determined to be LAER in California
25 and other ozone non-attainment areas of the United States.
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35 **Q. Mr. Sagert and Connie Hoag testified that the Lower Fraser Valley and**
36 **Whatcom County already have an atmospheric visibility problem, and that "any**
37 **small addition of emissions to the airshed could more significantly deteriorate**
38 **that visibility." Do you agree?**
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42 A. As I noted above, any increase in emissions will have an effect – the question is
43 whether or not it is significant or even noticeable. A strict comparison of S2GF
44 emissions with regional emissions, which is appropriate when addressing regional haze
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1 concerns, indicates the plant would have a small impact on visibility. It is worth noting
2 that the concerns about visibility have increased with population growth – Peter Sagert
3 notes a 133% increase in Abbotsford area population between 1979 and 1998.
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5 Increased spraying of waste from animal husbandry in the last decade has also been
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7 identified as a significant contributor to regional haze problems in the area.
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12 Visibility is a very difficult issue to address because it there is no prescribed method to
13 evaluate it. Visibility effects depend on the source characteristics such as particle size
14 and composition, gaseous emission rates and chemistry; meteorological factors such as
15 wind speed, wind direction, humidity, mixing height; geographic considerations such
16 as the sun zenith and azimuth; target characteristics such as the color (black, white,
17 gray, blue) of the background; and the concentration and chemistry of pre-existing fine
18 particulate matter in the atmosphere. As Peter Sagert acknowledges: “It is admittedly
19 difficult to express visibility effects in a form easily understood by the public and by
20 administrative decision makers.”
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32 In our April response to MELP, we devoted 15 pages to the subject of S2GF’s effect
33 on visibility in the Lower Fraser Valley. To estimate seasonal background aerosol
34 concentrations for low (10th percentile), median (50th percentile), and high (90th
35 percentile) extinction conditions, we evaluated weekly extinction coefficients
36 measured by Environment Canada in the Fraser Valley from February 1996 through
37 February 1997. We considered the incremental effect of S2GF emissions with these
38 background conditions for six lines-of-sight in the eastern Fraser Valley. We
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40 considered two criteria for defining an impact: 1) a visual range of 60 kilometers or
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1 less (as determined by S.C. Pryor in visibility study in Abbotsford); and 2), a change in
2 the extinction coefficient of 5 percent from the background condition (representative
3 of a “just noticeable” change). We then presented tables identifying the probability of
4 visibility impairment for various combinations of lines of sight, background extinction
5 coefficient, and season. We found that changes to extinction are small when S2GF is
6 gas fired, but that emissions with oil firing had the potential to perceptibly reduce
7 visual range on up to 25 percent of winter days with good existing visibility. In short,
8 oil firing is expected to occur rarely but would have the potential to effect visual range
9 in the Fraser Valley based on the perceptible change criterion. By presenting the
10 results of our calculations in a series of tables, we also enabled MELP to use their own
11 criteria to determine whether the impact was “significant.”
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24 Of course, the opportunity to offset emissions of particulate matter and other
25 pollutants from S2GF by controlling an existing facility in the Fraser Valley has the
26 potential to provide a net benefit to visibility in the Fraser Valley and Whatcom
27 County.
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34 **Q. At page 19, Mr. Sagert has questions about the project's compliance with NOx**
35 **limits. Can you respond to his concerns?**
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37 **A.** This concern was not entirely clear, but I believe Mr. Sagert was suggesting that we
38 identify the averaging time for the proposed NOx limits. That is a detail usually
39 addressed during the preparation of the PSD permit itself, not in the application.
40 Based on current EFSEC permits for recently permitted projects, the NOx limit will be
41 expressed in parts per million (ppm) and pounds per hour averaged over a one-hour or
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1 twenty-four hour period. A continuous emission monitor (CEM) will likely be
2 required to ensure compliance with these limits.
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6 **Q. Mr. Sagert compared the S2GF project to the Burrard Thermal Plant in**
7 **particular. Can you compare the emissions of the S2GF plant with Burrard and**
8 **other power plants recently permitted in British Columbia?**
9
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11 **A.** With the recent addition of SCR, Burrard Thermal is a clean plant – especially when
12 its size and age are considered. As Mr. Sagert points out, however, Burrard
13 Thermal’s air permit allows nearly 5 times the annual NOx emissions that SE2
14 proposes while only producing 45 percent more electricity. Lower NOx from S2GF is
15 partly due to the more efficient generation achieved by combined cycle projects.
16 However, S2GF would also have greater ammonia slip (up to 10 ppm) through its
17 SCR than Burrard Thermal (up to 3.3 ppm).
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27 I am aware of two power plants in the permitting process on Vancouver Island. Based
28 on my reading of the permit applications, SCR would not be employed in either plant.
29 Both plants would provide less than half the generating capacity of S2GF, but each
30 would emit more than 800 tons of NOx per year. S2GF would emit approximately
31 159 tons per year with the proposed enhanced SCR if it operated 365 days per year,
32 including 15 days with oil.
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42 **Q. Mr. Sagert expressed concern about air emissions having adverse impacts on**
43 **plants and agricultural crops. Is his concern well-founded?**
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1 A. We are not aware of any U.S. or Canadian standard specifically established to protect
2 vegetation. It is likely that plant species vary considerably in their tolerance to air
3 pollution, and that relatively few species have been studied in detail. However,
4 Environment Canada's photochemical modeling indicates S2GF would have only a
5 small effect on ozone episode intensity and no effect on ozone episode duration. Our
6 modeling has demonstrated that the project would not cause violations of U.S. or
7 Canadian air quality standards.
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16 Our modeling has also demonstrated that nitrogen and sulfur deposition rates
17 attributable to S2GF would be a small fraction of existing deposition rates. The
18 maximum annual nitrogen deposition attributable to S2GF would be 0.05 kg/ha/yr,
19 compared with 8.6 kg/ha/yr measured by Environment Canada in the Lower Fraser
20 Valley during 1996.
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28 Our modeling indicates the sulfur deposition at the worst-case location in Canada
29 would be 0.07 kg/ha/yr, compared with an existing value of 0.6 kg/ha/yr. The U.S.
30 Forest Service's Guidelines for Evaluating Air Pollution Impacts on Class I Wilderness
31 Areas in the Pacific Northwest cites research indicating "20 kilograms of sulfur per
32 hectare per year is the maximum long-term deposition that can be tolerated without
33 impacts in most terrestrial ecosystems" and "effects are very unlikely below 5
34 kilograms per hectare per year." This suggests that sulfur deposition is not a problem
35 in the Lower Fraser Valley. Both the nitrogen and sulfur deposition maxima occur on
36 Sumas Mountain; S2GF deposition rates in the agricultural area would be lower.
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1 **Q. Finally, let me ask you about the impact of air emissions on the view from Ms.**
2 **Hoag's property. Mr. Gustafson testified that if Ms. Hoag's property, which has**
3 **a view of Mt. Baker, lost its entire view of the mountain, it would decrease in**
4 **value by \$35,000, and that it would experience some diminution in value “if the**
5 **view of a snow-capped mountain were replaced with a view of a smog blanket.”**
6 **Based on the modeling analysis you have performed, do you believe emissions**
7 **from the S2GF project will result in the sort of impact on the view from Ms.**
8 **Hoag's property that Mr. Gustafson discussed?**

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16 **A.** In our April response to MELP, visibility in the Lower Fraser Valley was assessed for
17 six lines-of-sight. One of those lines-of-sight was for an observer in Abbotsford
18 looking at Mt. Baker. Although this line-of-sight is not exactly the same as it would
19 be from Ms. Hoag’s property, I would expect the general finding to apply. The
20 criterion for assessing a perceptible change was a 5 percent change in the extinction
21 coefficient, the same criterion that we applied to the assessment of visibility in Class I
22 areas. We consider this to be a conservative indicator of visibility impairment. Our
23 analysis indicated only a small change of perceptibly reduced visual range for the Mt.
24 Baker line-of-sight, primarily when S2GF is fired by oil on a day with good
25 background visual conditions.
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39 Based on our assessment, the S2GF will not result in Ms. Hoag losing her view of Mt.
40 Baker or finding it replaced by a view of a “smog blanket.” I would not expect its
41 operations to affect visibility to such an extent that it would have any impact on the
42 value of Ms. Hoag’s property.
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Greenhouse Gas Emissions

Q. Dr. Jaffe and Dr. Gammon have testified that S2GF will add 3% to Washington's total emissions of greenhouse gases. Do you agree with that characterization?

A. I believe these statements refer to increases over Washington's 1990 greenhouse gas emissions, which I found at an EPA web site. I concur that S2GF greenhouse gas emissions are equal to approximately 3% of the emissions in the state in 1990. Whether S2GF will increase greenhouse gas emissions in the state, however, depends upon whether all existing emission sources continue to operate or whether the S2GF would displace other sources. I'd like to think that combined cycle plants such as S2GF will displace older, coal-fired plants, such as those in Centralia, Washington and Colstrip Montana, which generate greater greenhouse gas emissions, toxic air pollutant emissions, and criteria pollutant emissions. I assume that Dr. Jaffe and Dr. Gammon would concur that displacing coal-fired plants would be a step in the right direction in terms of climate impacts as well as overall air pollution impacts.

Q. Mr. Sagert indicates you should have included N2O emissions from S2GF when identifying greenhouse gas emissions. Is that correct?

A. Nitrous oxide (N2O) is a greenhouse gas, but was not considered in the S2GF analysis because the effect is so small. N2O is emitted by gas turbines, and it has a greater greenhouse effect per pound emitted than carbon dioxide. Using EPA's emission factor for N2O (EPA "AP-42" emission factor document) to correct for the greater greenhouse impact potential of N2O and including N2O emissions as CO2-equivalent increases the S2GF CO2 emissions by less than 1 percent.

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3 **Q. A few witnesses have testified that EFSEC should require SE2 to fully offset its**
4 **greenhouse gas emissions through mitigation projects, sequestration projects or**
5 **other offset mechanisms. Do you agree with that recommendation?**
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9 **A.** I agree that climate change and greenhouse gas mitigation are important policy matters
10 that should be addressed. As I stated in my direct testimony, however, I do not
11 believe ad hoc greenhouse gas mitigation requirements make sense. Greenhouse gas
12 mitigation needs to be a carefully conceived national or even international commitment
13 that affects all sources of emissions. Imposing significant mitigation requirements on
14 S2GF, which contributes at most 3% of the state greenhouse gas emissions, would
15 have a significant effect on the project economics but would have a negligible effect on
16 statewide emissions.
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26 Even if all the combined cycle generating plants being considered by EFSEC were to
27 have greenhouse gas mitigation, the overall benefit would be small. Much greater
28 benefits could be obtained if the proposed combined cycle units displaced coal-fired
29 generating plants. At worst, we fool ourselves into thinking that by mitigation
30 emissions from these highly efficient combined cycle facilities, we could defer much
31 more important steps to control the major sources of greenhouse gases:
32 transportation, space heating, and coal-fired generating stations.
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3 **Sound Emissions**
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5 **Q. In his testimony, Mr. Lilly expressed a concern about whether the facility would**
6 **comply with legal limits on noise, and Dr. Lipscomb testified that he expected**
7 **the noise to be greater than you had predicted. How do you respond to their**
8 **concern?**
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13 A. SE2 has assumed from the beginning that EFSEC would require the project to comply
14 with applicable state and local noise regulations. SE2 has also entered into a
15 stipulation with the City of Sumas specifically agreeing to comply with the City's noise
16 ordinance. We spent several weeks performing a quantitative evaluation of the
17 predicted sound levels during S2GF operation, and determined that the project would
18 comply with those established regulatory limits. Although Mr. Lilly and Dr. Lipscomb
19 express some generalized doubts about whether compliance can be achieved, neither
20 witness offered any data or analysis that demonstrates a compliance problem.
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25 I should explain that our first analysis did show that sound levels would exceed the
26 nighttime standard at some residential locations. We then spent considerable time
27 investigating appropriate mitigating measures to reduce noise impacts, and SE2 agreed
28 to incorporate these measures into the proposal. These measures are detailed in
29 section 4.1 of the Application. We are now confident that the project will comply with
30 the nighttime sound limits. Moreover, as we pointed out in the application, we expect
31 actual sound levels to be lower than predicted, primarily because of conservative
32 assumptions in our modeling but also because of the tendency for vendors to overstate
33 equipment sound levels to ensure that their equipment will meet their own guarantees.
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3 Finally, it is important to keep in mind that the noise analysis we prepared for the
4 Application and the EIS is only a first step. We needed to determine if the project
5 could meet the standards, and our assessment indicates that it can. The project has not
6 been completely designed, and neighbors should not assume that efforts to reduce
7 noise are complete. SE2 understands that they must comply with regulatory noise
8 limits, and I am confident that the evaluation of additional opportunities to increase
9 their margin of compliance will continue.
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18 **Q. Ms. Park was generally quite complementary of your analysis but took exception**
19 **to your calculation of predicted cumulative noise impacts. She concluded that**
20 **there would be a "noticeable" increase in nighttime noise. What is your**
21 **response to her testimony?**
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26 **A.** We appreciate Ms. Park's efforts to carefully review our modeling before submitting
27 her testimony, and we were pleased by her favorable review of our work. I agree that
28 our modeling indicates that noise from S2GF will be noticeable from nearby residential
29 properties during the quietest hours. We will continue to work on further measures to
30 reduce noise during continuing design efforts.
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38 **Q. Ms. Park and Mr. Lilly expressed concern about low frequency noise and Ms.**
39 **Park provided some calculations about predicted levels of low frequency noise.**
40 **How do you respond to this concern?**
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44 **A.** Our analysis was based on octave band information provided primarily by equipment
45 vendors. Thus, our analysis considered the relative sound contribution from audible
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1 frequencies. We provided Ms. Park the output files from our Environmental Noise
2 Model, and her presentation of MFG's predicted sound levels in the lower frequencies
3 was accurate.
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8 As Ms. Park acknowledged, Washington environmental noise regulations do not
9 include frequency-specific standards. It is not clear what level of frequency noise
10 would be considered acceptable if there were applicable Washington regulations.
11 However, Mr. Lilly stated that the overall, unweighted levels should be less than 80
12 dB. The highest unweighted sound level from all on-site sources would be 75 dB.
13 According to Mr. Lilly's testimony, this should be protective of nearby residents.
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22 Mr. Lilly also expressed concerns about tones. A tone is a noticeable sound
23 concentrated in a certain narrow frequency range – narrower than the octave bands
24 discussed above. Mr. Lilly indicates that tonal equipment should be 40 dBA or lower.
25 However, several sources indicate that equipment levels should be reduced by 5 dBA
26 below noise limit if it contains a pure tone component (Acoustics and Noise Control
27 Handbook for Architects and Builder, Richards, 1998; and King County Code
28 12.88.030). In this setting, the appropriate limit for a tone would be 45 dBA at
29 residences. One potential source of tone would be the transformers, with a distinctive
30 tone near 120 Hz. Our predictions indicate the highest noise level from all
31 transformers is 44 dBA at the nearest residences, which would meet these criteria.
32 Another potential source of a pure tone is the stack tip. Our model predictions stack
33 tip sound levels of about 41 dBA or less, which is more than 5 dBA lower than the
34 night standard of 50 dBA.
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3 **Q. In your opinion, is there anything more SE2 should be doing to address low**
4 **frequency noise?**

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7 A. SE2 has already committed to significant mitigation of the intake air filters, the stacks,
8 the HRSGs, and the condenser. SE2 has also committed to enclosing the gas turbines
9 and gas turbine generators and the steam turbine in buildings and to erecting noise
10 barriers around the transformers. These measures will go a long way toward quieting
11 the noise at all frequencies. SE2 will continue to investigate sound attenuation
12 measures as it proceeds to the final design stage, and consider whether more should
13 reasonably be done to address low frequency noise.
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23 **Q. Ms. Grenzow testified that she sometimes hears a low rumbling sound that**
24 **fluctuates in intensity that she attributes to the Sumas Cogeneration Facility.**
25 **Ms. Hoag also testified that she hears a low rumbling noise that she attributes to**
26 **the existing Sumas Cogeneration facility, that the noise got worse when the IKO**
27 **plant came on line, and that she is concerned it will get worse when the S2GF**
28 **project goes on line. Will S2GF make the matter worse?**
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35 A. Ms. Grenzow said the low rumbling noise she hears sounds like a train, and fluctuates
36 in intensity. We acknowledge that power plants produce low frequency sound, but the
37 noise output is very steady. We would expect very little variation in the low frequency
38 sound if it were generated by the existing cogeneration plant.
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45 Ms. Hoag lives 3.3 miles west of the plant. Having heard Ms. Hoag make this
46 statement in public meetings, I asked our field technician to visit her neighborhood to
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1 determine if he could measure or hear the existing plant. Our technician has been
2 performing environmental noise measurements for 12 years, and is a very careful
3 listener and observer. With background sound levels in the low-30s dBA, he could
4 not measure or hear any noise in that area from the cogeneration plant. At that
5 distance, I do not believe that the proposed S2GF project will result in a noticeable
6 difference in nighttime noise levels. Mr. Jager testified that he can not hear the
7 cogeneration plant in his house, nor is he kept awake by it, and he lives half a mile
8 from the plant.
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18 It is possible that Ms. Grenzow and Ms. Hoag have superior hearing, but even then, it
19 is not always possible to determine the source of a particular sound that is heard. We
20 also find that people can become so fixated on a facility that they perceive impacts that
21 others cannot. To us, low rumbling sounds are often associated with trains (as
22 suggested by Ms. Grenzow's testimony) or distant aircraft takeoffs.
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31 **Q. Dr. Kronenberg and Dr. Lipscomb provided testimony regarding the potential**
32 **psychological and physiological effects of noise. Do you have any response?**
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34 **A.** I agree that excessive noise can result in adverse health effects. I do not believe that
35 the levels of noise we are talking about from the S2GF project would result in the
36 severe psychological and physiological effects described the Dr. Kronenberg and Dr.
37 Lipscomb's testimony. Dr. Kronenberg's discussion of vibroacoustic disease (VAD),
38 in particular, has nothing to do with the Sumas situation. VAD is caused by very high
39 levels of noise (greater than 90 dB) at low frequencies (less than 500 Hz). His
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1 discussion simply does not apply to a situation where maximum unweighted sound
2 levels are 75 dB or less.
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6 **Q. Finally, Dr. Kronenberg testified that all noise assessments should be**
7 **accompanied by a frequency spectrum analysis. Do you believe such an analysis**
8 **is necessary?**
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12 **A.** Our analysis was based on octave bands, which break the audible frequency spectrum
13 into 10 bands. Dr. Kronenberg may prefer more detailed evaluation of sound level
14 frequencies. We will attempt to address these concerns in the project's final design,
15 but they are not required by local, state, or federal noise criteria, and we have not,
16 therefore, conducted that level of very detailed and expensive analysis to date.
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22 **END OF TESTIMONY**
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